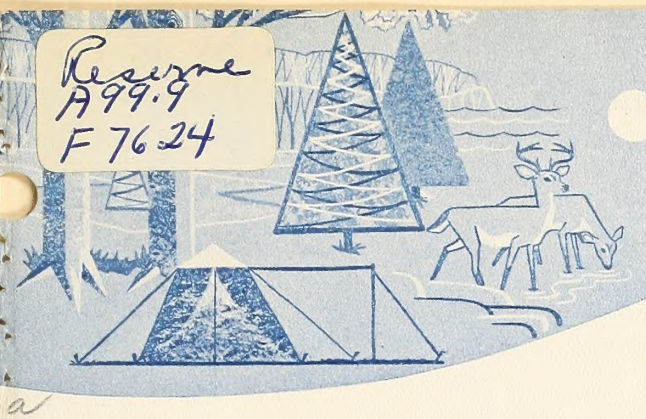

U. S. FOREST SERVICE

RESEARCH NOTE LS-67

LAKE STATES FOREST EXPERIMENT STATION, • U. S. DEPARTMENT OF AGRICULTURE

Alinement Chart for Numbers of Trees - Diameters - Basal Areas

The chart given here eliminates or simplifies many calculations involving relationships among numbers of trees, diameters, and basal areas.[1] If any two of these variables are known or can be estimated, the other can be found. This chart has many applications in forestry, both in the field and in the office. Some examples are given below.

Estimating Average Stand Diameters. — If the number of trees and basal area per unit of area are known (the unit of area can be an acre, a 10th-acre plot, or any other sized area), the diameter of the tree of average (mean) basal area can be simply estimated.

Place one end of a straightedge on the NUMBER OF TREES scale, for example 220 trees per acre, and the other end on the BASAL AREA scale, say on 90 square feet. The average diameter is read off the DIAMETER scale at the point where the straightedge crosses — 8.7 inches in this example.

Estimating Basal Areas. — If the number of trees of a given average diameter is known, their basal area is readily found. Aline the straightedge on the NUMBER OF TREES and DIAMETER scales and read off the BASAL AREA scale. The basal area for 400 trees averaging 6 inches in diameter is 78.5 square feet. Note that this same answer tells us that the basal area in 40 trees is 7.85 square feet; in 4 trees, 0.785 square feet. For the basal area of one 3.9-inch tree, find the basal area for 1,000 trees, 83 square feet, and divide by 1,000. Thus, one 3.9-inch tree has a basal area of 0.083 square feet. Any convenient number of trees can be used in this manner to find the basal area of a single tree or a group of trees of any diameter.

Estimating Diameter and Basal Area Growth. — If future values of any two variables can be estimated, then the third can be found. One use of this is to estimate stand diameter growth (the increase in diameter of the tree of average basal area). For example, after thinning a red pine stand to 90 square feet of basal area we have 220 trees averaging 8.7 inches in diameter. Over the next 10 years these 220 trees are expected to grow in basal area to 135 square feet, with no mortality. Thus, in 10 years the average diameter would be 10.6 inches (220 trees, 135 square feet), a growth of 1.9 inches.

Conversely, past ring counts may have indicated a future 10-year average diameter growth of 1.9 inches in this stand, from 8.7 to 10.6 inches. Knowing the present number of trees (220) would enable us to estimate the future basal area as 135 square feet if there is no mortality, a growth of 45 square feet (135-90).

This technique only approximates actual stand diameter and basal area growth. It applies best to stands with a narrow and even distribution of diameter classes, such as a well-spaced plantation.

Estimating Numbers of Trees To Be Cut In Thinning. — Another use of this chart is to estimate how many trees must be cut to thin to a given basal area (assuming a cut from above and below that does not change the diameter of the tree of average basal area by cutting). To illustrate, a stand averaging 10.6 inches in diameter with 220 trees and 135 square feet of basal area per acre is to be thinned back to 90 square feet. A stand with 90 square feet in 10.6-inch trees would have 147 trees. Thus, about 73 trees per acre would have to be cut to thin the stand back to 90 square feet.

Other applications of this chart may come to mind, but these examples illustrate its use in several problems commonly encountered in timber management.

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[1] *The formula used in constructing this chart was:*

$$BA = \frac{\pi}{144} \left(\frac{D}{2}\right)^2 N$$

$$BA = 0.005454\ D^2N$$

where BA *is total basal area in square feet,* D *is tree diameter breast high in inches, and* N *is number of trees on an area of known size.*

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OCTOBER 1965

MAINTAINED AT ST. PAUL 1, MINNESOTA, IN COOPERATION WITH THE UNIVERSITY OF MINNESOTA

NUMBER OF TREES - DIAMETER - BASAL AREA CHART